Целью данной работы является исследование кинетики распределения моноклонального антитела, соединенного с радионуклидом в организме человека и создание программного обеспечения, которое будет использоваться для расчета поглощенной дозы в зависимости от источника ионизирующего излучения и моноклоального антитела.

Для проведения исследований было выбрано моноклоальное антитело, которое используется для таргетной терапии. К нему был присоединен радионуклид, который в последствии воздействовал ионизирующим излучением на опухолевые клетки. Было исследовано, какую дозу радиации получают органы, взаимодействовавшие с данным антителом. С помощью созданного програмного обеспечения была рассчитана поглощенная доза в исследуемом органе человека.

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RADIOBIOLOGICAL MODELLING-BASED COMPARISON OF RADIOTHERAPY PLANS FOR NASOPHARYNGEAL CANCER

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Abstract. In this study, we consider a comprehensive approach to the selection of an optimal treatment plan for a patient with nasopharyngeal cancer. The approach is based on the evaluation of not only dosimetric radiation parameters but also radiobiological ones. Hence, it provides information about long-term consequences that is crucial for a qualitative radiotherapy.

Despite the rapid development of technologies that promote high-precision target volume irradiation, it remains essential to consider a late normal tissue response since the radiation-related complications have a tremendous impact on the quality of life. The complications may depend on a decision regarding a type of ionizing radiation [1-2]. Nevertheless, prescribing the treatment for a patient, insurance companies mostly follow the ALARA principle (as low as reasonably achievable) that states achieving of the greatest benefit for the patient at the lowest expenses. Such a solution is not always the most effective one in terms of achieving a therapeutic effect. Thus, an integrated approach based on the analysis of physical (dosimetric) parameters as well as radiobiological calculations should take place in a real practice in order to determine the most convenient type of radiation therapy.

In the research, we compared irradiation plans for both proton and photon radiotherapy for a patient with nasopharyngeal cancer. All the irradiation plans were designed in separate planning systems and then, imported into the VARIAN Eclipse 11.0 planning system to be able to compare and analyze them. As the result, we received Dose-Volume Histograms (DVHs) reflecting the dose distributions in both tumor and organs at risk. These results were compatible with the radiobiological modelling program BioGray which allowed us to move from the dosimetric quantities to a biological effect of the doses [3]. Therefore, in the BioGray, we performed calculations of normal tissues complications probability (NTCP) as well as tumor control probability (TCP) that comprise information about the late complications. According to these probability values we compared both treatment plans for proton and photon therapy.

The data obtained in the experiment show that the plans comparison based only on the dose distribution depicted on DVHs is not sufficient, whereas the radiobiological modelling makes it possible to calculate the probability of late effects through the NTCP and TCP. Eventually, it contributes to the determination of a radiation therapy strategy that is more likely to destroy the tumor while preserving the vital organs.

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